Portfolio123

Dynamic Position Sizing on Portfolio123
Market Cap Weighting, Smart Beta Weighting, and More

By
Marc Gerstein

Traditionally, Portfolio123 users had been confined to use of portfolios that started out with all positions equally weighted. Future variations were determined by the market (winners wound up with higher weights and vice versa for losers) subject to limits the user may have specified in Buy or Sell rules. This approach continues to be available when a user chooses to allocate position sizes based on what is now referred to as "% Portfolio Weight."

Those who wish to explore and use alternative weighting/sizing protocols should choose "Formula Weight." The selection is made in the second step of simulation/portfolio construction, a step formerly labeled "Position Sizing" but which is now referred to as "Reconstitution & Rebalance."

Traditional Sizing (% Portfolio Weight)

Those who wish to continue to use the position sizing approach thy had been using in the past will, when they click on Reconstitution & Rebalance, see this:

The main differences between this and the traditional interface are that the choices of reconstitution period (formerly referred to as "Rebalance Frequency") and the presence of the choice whether to allow sold holdings to be re-bought as current reconstitution, which has been moved here from their former location under the General tab. (The other difference, of course, is the availability of the un-selected Formula Weight method.) The reason for the renaming of old Rebalance Frequency will become apparent in the next section.

Let's now turn to the new offering, which you'll see if you choose Formula Weight.

Dynamic Sizing (Formula Weight)

This interface is much more involved.

Choice 1

After choosing Formula Weight, you'll start with a familiar decision: How many positions would you like to ideally hold in your portfolio? Enter the number. The platform will calculate the ideal target percent as it would be if we were to continue to naively assume equal weighting.

Choice 2

Under traditional % Portfolio Weights, you only had one decision to make regarding routine updates; how often you would re-run the model and plug new positions into whatever weights they would get based on how many positions would be purchased and how much cash was available.

For formula weighting, we need to think of updates as being two decisions.

1. How often do you want to re-run you model to determine what, if any, stocks need to be sold and purchased?
   a. The re-running of a model is referred to as "reconstituting" the portfolio.
2. How often do you want to leave the roster of stocks as is but nudge your existing positions (some of which will have risen to the point of holding higher-than-desired weightings and vice versa with declining stocks) back toward their target weights?
   a. This process, the adjustment of weights without the addition or subtraction of any portfolio holdings, is referred to as rebalancing.

You can, if you wish, set identical intervals (say three months) for both reconstituting and rebalancing. But you don't have to do that. You might decide to rerun your model and reconstitute your portfolio once every three or six months, but rebalance toward target weights more frequently, say once every four weeks. *Note: As you work with formula weights, you may find that the capabilities afforded by dynamic position weighting and rebalancing allow you to reconstitute less frequently than you did in the past.*

Most users will choose rebalancing intervals that are equal to or more frequent than reconstitution intervals.

- Note, though, that the platform will allow you to reconstitute without rebalancing. If you choose to do so, positions not sold will retain their current weightings and new positions will be equally allocated based on the available funds. Just to make sure this is what you want, rather than something you allow to happen by accident; the platform will remind you of this default protocol any time you make choices that indicate reconstitution without rebalancing.

Choice 3

This is where you decide how you want to weight positions in your portfolio. You can simply type in a factor or formula. If you choose market capitalization weighting, it can be as easy as typing: MktCap.

It's also pretty easy if you want to try a simple "smart beta" approach and use something like SalesTTM as the basis for weighting.

If you want to go beyond that, you'll probably want to click on " > Reference " at the right edge of the formula bar. Doing so will call up the undoubtedly very familiar factor-formula lookup-input interface:
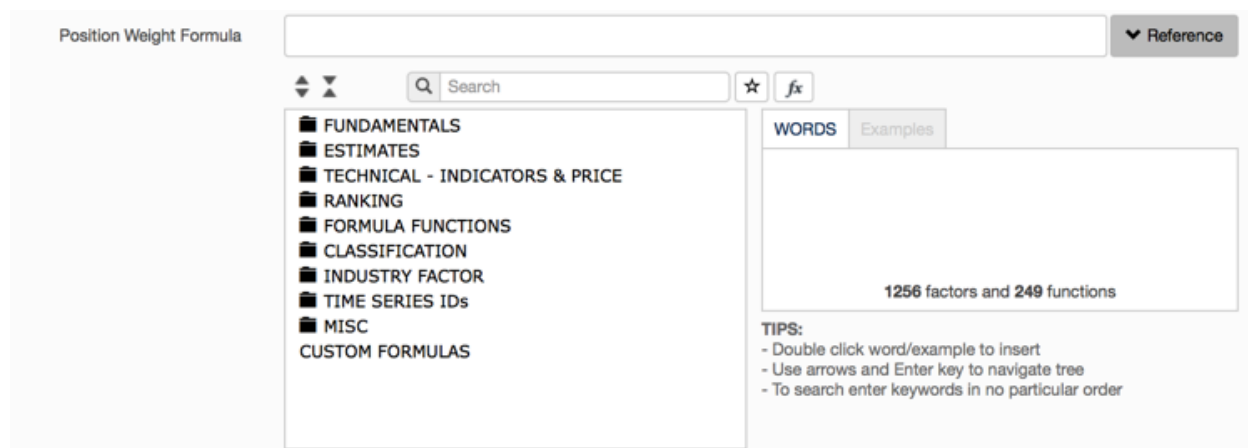
You can now type in or create via point and click any sort of Portfolio123 factor or formula you may wish to use, including, but by no means limited to Rank, Rating(), and FRnak(). Considerations relating to the the pros and cons of various choices are discussed in Topic 9 of the Portfolio123 Virtual Strategy Design class.

Choice 4

Here, you choose whether to set upper and/or lower boundaries that limit and over-ride extreme weightings that may be produced by your formula.

This could be a very important step. If you need convincing, create 5- or 10-stock portfolios that uses market capitalization weighting. It won't be hard to wind up with an absurd situation in which one mega-stock, such as AAPL, turns out to comprise 98% or so of the portfolio with the others left to divvy up the crumbs.

This, by the way, is why the platform calculates the naïve equal-weighting percentage based on the number of positions you want to hold. We know you don't really want equal weighting here. But having this number can help supply a handy frame of reference as you make choices regarding upper and/or lower boundaries.

Details of how we re-calculate weights in order to comply with the limits you establish are set for the in Appendix

* * *

Those are the basics. Those four choices are all you need to get going and accomplish quite a lot. But for those who would like to fine tune their models more tightly, there are some other choices available to you.

Advanced Choices

- Tolerance

If pure application of your weighting formula suggests a 12.6% weighting and at the next rebalancing, this position slips to 12.3%, must you buy more to bring the position up to snuff?

Strictly speaking, yes, you must. But being this picky with enough positions can lead to cumbersome, and potentially expensive, trading. You can avoid that by specifying here a degree of deviation you will accept without triggering the need to actually make the mandated adjustment to your position.

- Illegal Formula Values

If you set your choice here to "Trigger Error," you may be amazed at how many errors you wind up with even if you are diligent in articulating your formulas. Just think of lf those NA or NM values out there, and think of the odd places in which you can encounter zeros.

By default, the interface is set to "Skip or Sell" which, for all practical purposes, assumes the weight it set to zero, with whatever trading that may entail, and let's the algorithm continue along its way with the rest of the portfolio. If you find that too many stocks were zeroed out of the portfolio, then you may want to trigger the error to see where you need to make revisions.

- Rebalance Minimum

Rebalancing always works very smoothly in hypothetical examples. Real life can be messier. Would you want to execute a mandated rebalance if it only involved couple of shares, or less cash than you have right now in your wallet? Setting rebalance minimum to "Off" will cause you to do just that. But if you turn it on, you can eliminate trivial transactions as you define them (in terms of %, number of shares, or dollar amounts).

- Transaction Scaling

Truly being "fully invested" is much more easily said than done. Unless we're dealing with the ability to buy and sell fractional shares, our real life fully invested portfolios are likely to contain some cash; not a lot and maybe even less than a percent, but something.

Assuming your portfolio does contain spare (frictional, let's call it) cash, how do you want to address it at rebalance time? If you check "Leave in cash or margin," you'll cordon it off from being used to fund rebalance-related purchases

In other words, assume you have a $10,000 portfolio consisting of $9,987 worth of stocks and $13 in frictional cash. Assume it's rebalancing time. Can you touch that extra $13 or are you limited to working only with the $9,987?

The default choice ("Scale for Available Funds") allows you to try, if you can, to take this opportunity to use all or as much as you can (subject to what can be accomplished without use of fractional shares) of the spare $13.

Note, though, that checking "Leave in Cash or Margin" won't necessarily keep the $13 buffer as is. Maybe, you'll only be able to invest $9,975 this time around. That adds another $12 to your pile of extra cash thus bringing it to $25. This still seems like no big deal. Remember, though, real life portfolios may be working with bigger percentages than this, and also that cordoning off the extra cash will probably cause it to grow, as just illustrated, each time you rebalance. So think carefully before you alter the default "Scale for Available Funds" option to make sure you're doing it as a result of thoughtful choice.

- Min/Max Scaling

This choice addresses a decision as to how to deal with a portfolio that can't find enough stocks to get fully invested. Should you invest what you can and leave the rest in cash? Or, should you apply all the cash you have to the smaller number of eligible stocks?

Here's an example.

Suppose your portfolio aims for 20 positions and sets weighting boundaries of 3% at minimum 7% at maximum.

Suppose further, that due to the interaction of market conditions and your Buy rules, you wind up holding only 10 positions. If this scaling feature is disabled, you can only be be between 30% and 70% invested.

If, on the other hand, you choose to "Scale by number of positions," the platform will notice that you have fewer than 20 positions and scale up the constraints so they make sense for the new, lower, number of positions, which in this 10-positin example would be lower and upper boundaries of 6% to 14% respectively.

APPENDIX – Implementing Maximum- and Minimum-Weight Boundaries

Here's a spreadsheet that illustrates the process.

	A	B	C	D	E	F	G
1	HYPOTHETICAL PORTFOLIO						
2				Stocks	Mkt Cap ($ mill.)		
3	Weighting Formula:	MktCap		ABC	1,000		
4	Number of positions:	5		DEF	10		
5	Ideal Equal Weight:	20.0%		GHI	8		
6	Minimum Weight:	5%		JKL	4		
7	Maximum Weight:	40%		MNO	1		
8				Total	1,023		
9	Computing the weights						
10							
11	Stocks		Mkt Cap ($ mill.)	Raw Mkt Cap Wt.	Step 1	Step 2	Step 3
12	ABC	ABC	1,000	97.75%	40.00%	40.00%	40.00%
13	DEF	DEF	10	0.98%	5.32%		15.11%
14	GHI	GHI	8	0.78%	5.25%		15.06%
15	JKL	JKL	4	0.39%	5.11%		14.96%
16	MNO	MNO	1	0.10%	5.00%		14.88%
17	Total	Total	1,023	100.00%	60.67%		100.00%

The key formulas are as follows:

Step1 – Re-compute weights after complying with the boundaries
E12 =$B$6 + (D12 - $D$16) * ($B$7 - $B$6) / ($D$12 - $D$16)
    = Allowable Minimum + ((Actual Hi-Low Gap) * (Allowable Hi-Low Gap))/Actual Hi-Low Gap
E13 =$B$6 + (D13 - $D$16) * ($B$7 - $B$6) / ($D$12 - $D$16)
E14 =$B$6 + (D14 - $D$16) * ($B$7 - $B$6) / ($D$12 - $D$16)
E15 =$B$6 + (D15 - $D$16) * ($B$7 - $B$6) / ($D$12 - $D$16)
E16 =$B$6 + (D16 - $D$16) * ($B$7 - $B$6) / ($D$12 - $D$16)
E17 =SUM(E12:E16)

The proportions are now correct and in compliance with the high and low boundaries. But in this example, the portfolio is likely to be over- or (as is the case in this example) under-invested.

Step 2 – Choose a Boundary for use in scaling all the weights up or down so they total 100%
F12 =IF(E$17 > 1, $B$6, $B$7)
    = If the sum of the preliminary weights is above 100%, use the allowable minimum as a
      scaling factor; otherwise (as in this example), use the allowable maximum

Step 3 – Compute Final Weights
G12 =F$12 + (E12 - F$12) * (1 - F$12 * $B$4) / (E$17 - F$12 * $B$4)
    = Preliminary position weight + ((preliminary weight – preliminary total) * (1- scaling factor
      * number of positions)) / preliminary total – preliminary weight * number positions)
G13 =F$12 + (E13 - F$12) * (1 - F$12 * $B$4) / (E$17 - F$12 * $B$4)
G14 =F$12 + (E14 - F$12) * (1 - F$12 * $B$4) / (E$17 - F$12 * $B$4)
G15 =F$12 + (E15 - F$12) * (1 - F$12 * $B$4) / (E$17 - F$12 * $B$4)
G16 =F$12 + (E16 - F$12) * (1 - F$12 * $B$4) / (E$17 - F$12 * $B$4)
G17 =SUM(G12:G16)